Measurement of ^{3}He Elastic Electromagnetic Form Factor Diffractive Minima Using Polarization Observables

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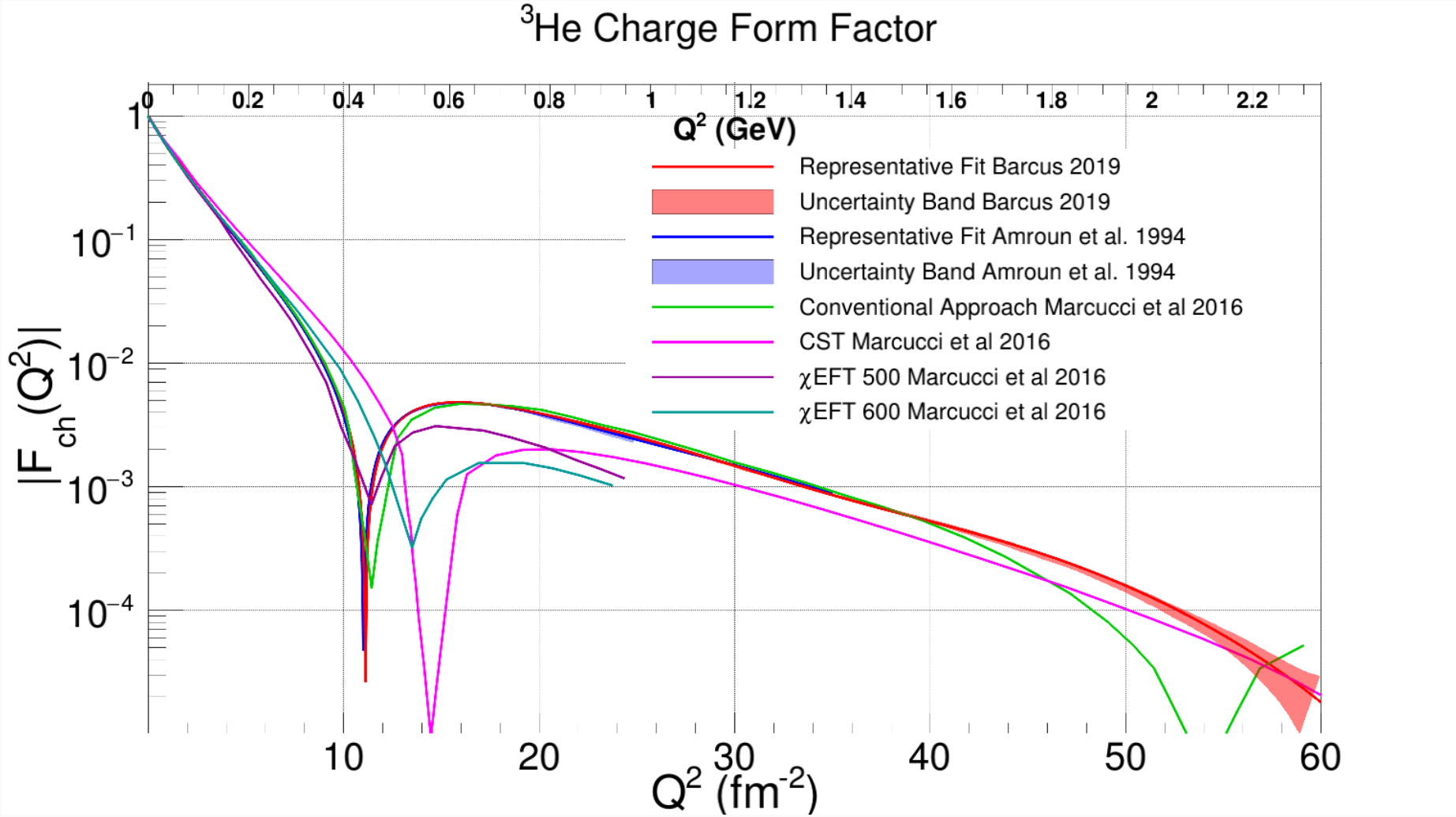
Parallel Running with d_2^n

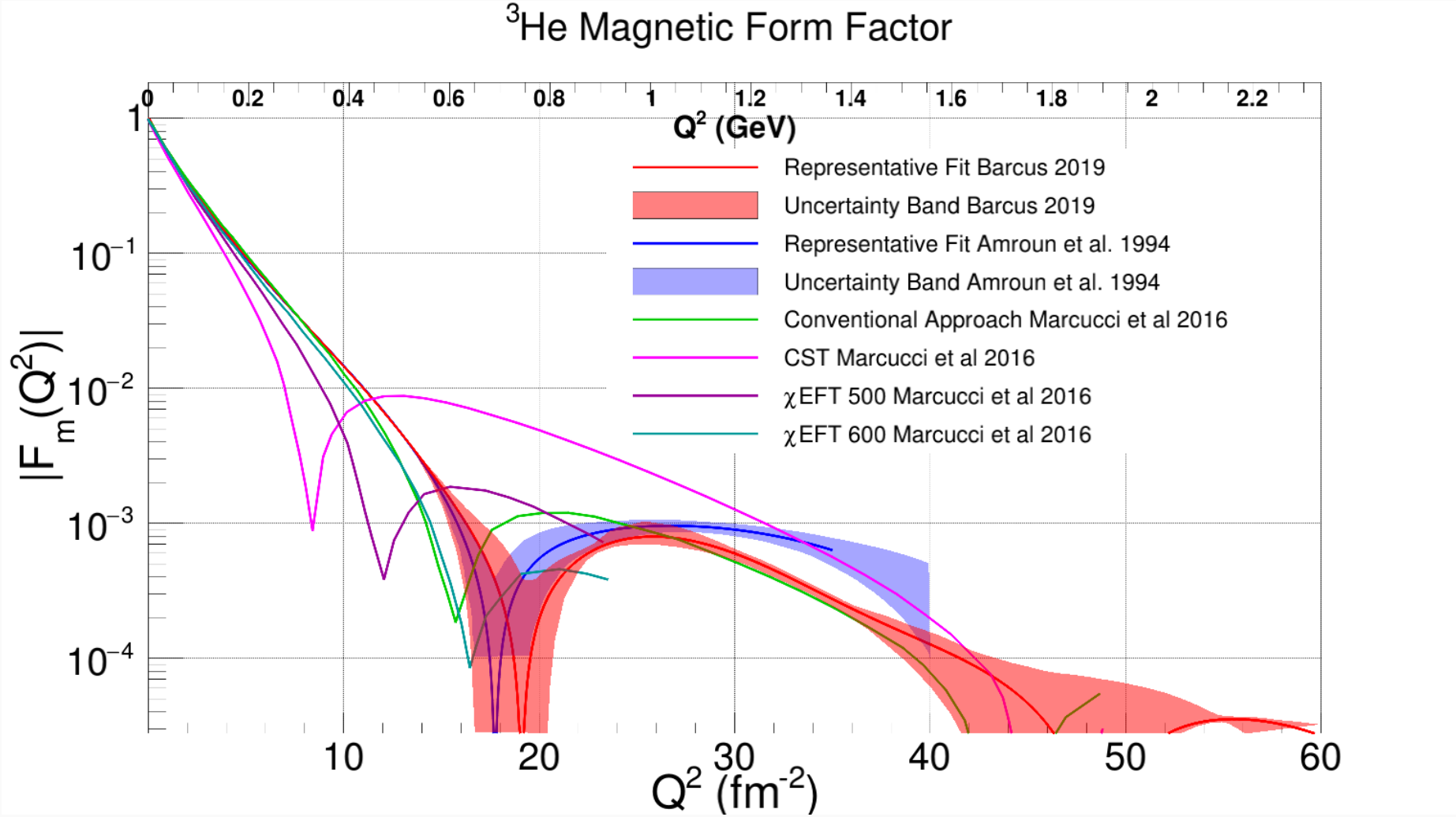
- d_2^n: Measure neutron g_2 and d_2 at high Q^2.
- 53 calendar days 5^{th}-pass production.
- 3 calendar days at 1^{st}-pass for systematics.
  - ^{3}He double-polarization asymmetry will run in parallel with these 1^{st}-pass systematics measurements.
  - No modifications required to any equipment.
  - Only requirement is to reposition the spectrometers.

Modern ^{3}He Form Factors



^{3}He F_{ch} modern sum of Gaussians fits.

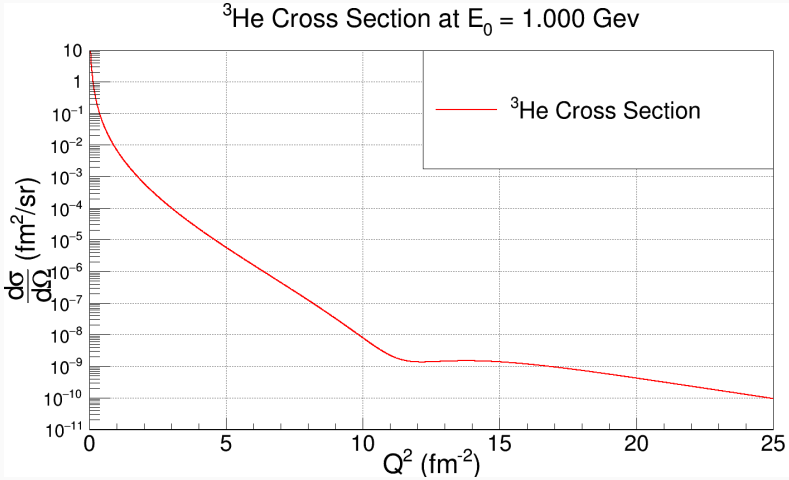
Modern ^{3}He Form Factors



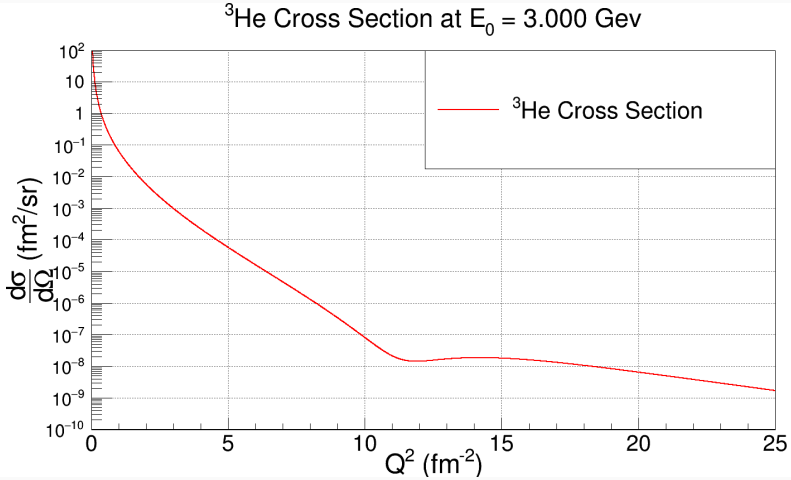
^{3}He F_m modern sum of Gaussians fits.

Form Factors from Cross Sections

- ^{3}He cross section at 1 GeV and 3 GeV.



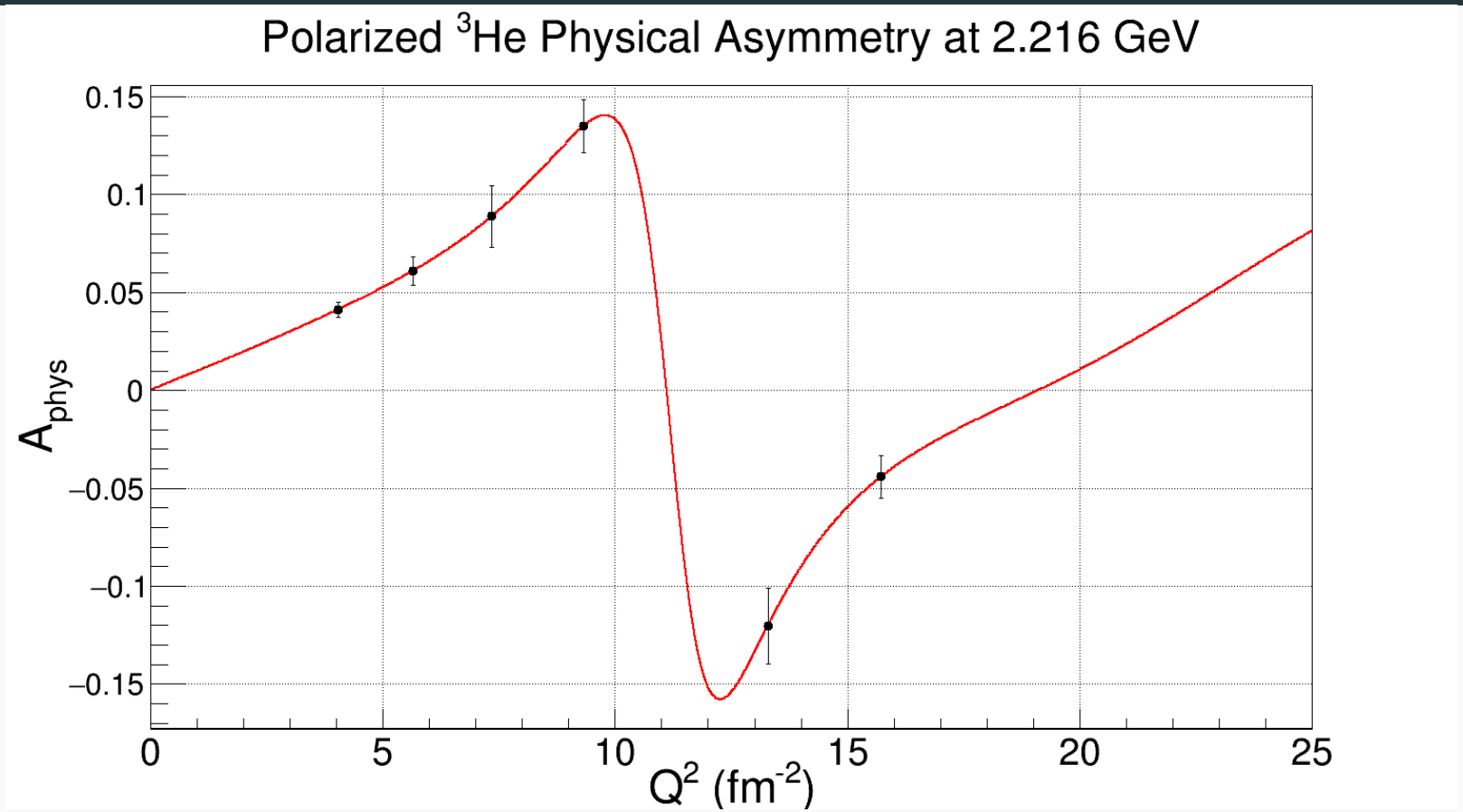
^{3}He cross section at 1 GeV.



^{3}He cross section at 3 GeV.

- Shallow cross section minima are used to extract sharp form factor minima.

Double-Polarization Asymmetry



Double-polarization asymmetry at 2.216 GeV. The points show the statistical uncertainty of the mean of each kinematic setting.

- Uncertainties are statistics limited. Systematics are small.
- Offline discussions are ongoing about optimizing these points.
  - Highest kinematic may be removed and split into two points to better measure first zero crossing.

Conclusions

- In collaboration with d_2^n we propose to measure the double-polarization asymmetry of ^{3}He over a range of Q^2.
  - Run in parallel with 1^{st}-pass systematics measurements.
- This will be the first high Q^2 measurement of ^{3}He form factors using polarization observables.
  - Constrain the locations of the diffractive minima.
  - Provide new method to hypothesis test theory predictions.
  - Determine if polarization observables agree with unpolarized Rosenbluth results.
  - Help explain the discrepancies between theoretical predictions and experimental measurements of the ^{3}He form factors.
- History has shown that polarization measurements can reveal problems with cross section extracted form factors (Jones *et al.* 2000).

Backup Slides

	θ [°]	Q^2 [GeV]	QE Rate [Hz]	Elastic Rate [Hz]	Total Rate [Hz]	Prescale	Final Elastic Rate [Hz]
SHMS	11	0.157	76708	3655	233779	52	70.30
	13	0.22	31469	469	94877	22	21.31
	15	0.286	13820	45.01	41505	10	4.50
	17	0.363	6120	3.03	18363	5	0.61
	19	0.517	2691	0.52	8073	2	0.26
HMS	21	0.612	1200	0.40	3599	1	0.40

Spectrometer Central Kinematics